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10-9-03

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

David ALUMOT, et al.

Docket No: 002187 USA/MC03/PDC/WF/OR (CA1120)

Appln. No.: 09/765,995

Group Art Unit: 2623

Confirmation No.: 1810

Examiner: Martin MILLER

Filed: January 19, 2001

For: OPTICAL INSPECTION APPARATUS FOR SUBSTRATE DEFECT DETECTION (as amended)

RESPONSE UNDER 37 C.F.R. § 1.111

MAIL STOP NON-FEE AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated May 28, 2003, for which the Examiner set a three-month period for response, Applicants submit the following remarks.

Claims 96-105 are all the claims pending in the application.

Claims 96, 97, 100, 101, 104, and 105 stand rejected under 35 U.S.C. §103(a) as being unpatentable over USP 4,764,969 to Ohtombe et al. in view of USP 5,185,812 to Yamashita et al. Claim 98 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Ohtombe and Yamashita, further in view of USP 4,791,586 to Maeda et al. Claims 99 and 102 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Ohtombe, Yamashita, and Maeda, further in view of USP 4,618,938 to Sandland et al. Claim 103 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Ohtombe and Yamashita, further in view of Sandland. Applicants respectfully

traverse these rejections, and request reconsideration and allowance of the claims in view of the following arguments.

Among other elements, independent claim 96 and its dependent claims recite a comparator, which calculates a difference between inspection signals and a reference signal to identify locations on a substrate suspected of having defects thereupon based on a threshold.

The Examiner has agreed that Ohtombe fails to disclose a comparator that calculates a difference between inspection signals and a reference signal. However, the Examiner asserts that Yamashita discloses such a comparator. The Examiner then combines Ohtombe and Yamashita, and rejects claims of the present application. Applicants respectfully disagree, and assert that the Examiner's combination of the prior art is improper. Given the completely different solutions used by the two cited references, and the lack of any need for a reference signal or a comparator calculating a difference between inspection signals and a reference signal in Ohtombe, there would be no reason to combine these two references. There is no teaching or suggestion to make the combination proposed by the Examiner, neither is there reasonable expectation of success.

Before proceeding to discuss the substance of the Examiner's rejection in detail, Applicants acknowledge the May 19, 2003 discussion between the Examiner and the undersigned concerning the Yamashita reference. During that discussion, the undersigned pointed out that both Ohtombe and Yamashita were of record during the prosecution of commonly-owned USP 6,178,257, with respect to which Applicants have filed a Terminal Disclaimer in the present application.

Moreover, the Examiner of the '257 patent applied the Ohtombe and Yamashita references separately against different claims in that application, and so presumably had familiarized himself with the teachings of those references.

Application claim in the '257 patent, while different from claim 96 of the present application, recited, among other things, a combination including a comparator. The Examiner of the '257 patent never applied Yamashita against that claim 128, though he did apply it against other claims. The Examiner of the '257 patent applied Ohtombe against claim 128. Apparently that Examiner recognized the non-combinability of Ohtombe and Yamashita. Applicants provide the following discussion to point out why Ohtombe and Yamashita are not properly combinable, and why the ordinarily skilled artisan would not have made that combination.

Ohtombe's goal is to provide an apparatus which is capable of automatically performing both macroscopic whole inspection and microscopic point inspection without the need for human visual inspection. Ohtombe locates defect positions on a wafer surface by comparing brightness differences between reflections from unusual and normal portions on the surface.

As shown in Ohtombe Fig. 1, the Ohtombe apparatus comprises a macroscopic inspecting section A, used to inspect a whole wafer surface, and a microscopic inspecting section B, used to inspect particular points of the wafer surface. In macroscopic inspecting section A, a wafer 1 is irradiated almost horizontally by light from a light source 3. Images of the wafer surface by reflection are fed from an industrial TV camera 4 to an image processing section 5. The image processing section 5 processes and analyses images entered from the industrial TV camera using a preset procedure with a difference of diffuse reflection and Miller surface reflection, thus detecting

unusual positions on the wafer surface (Ohtombe, col. 2, lines 44-66). If there is a scratch or a defect on the surface of the wafer 1, the scratch or the defect causes diffuse reflection. On the other hand, the remaining portions of the surface cause Miller reflection. The images of unusual positions appear brighter than those of the normal surface (Ohtombe, col. 4, lines 39-45).

In contrast, Yamashita's goal is to avoid detecting dimensional errors due to rounded corners of a circuit pattern and thinning or fattening of line widths and a positioning error of an examination table as defects (Yamashita, col. 1, lines 52-55). Yamashita solves the false defect detection problem by equipping a pattern inspection apparatus with a pattern feature extracting function which permits extraction of features of a circuit pattern including edges and corners (Yamashita, col. 2, lines 12-22).

As shown in Yamashita Fig. 1A, a sensor data input section 1 generates multivalued image data representing the distribution of density of a two-dimensional inspected pattern. A design pattern data input section 10 holds reference pattern data representing a typical pattern of a circuit pattern on a magnetic disk. An arithmetic unit 17 subtracts the reference pattern data from the multivalued image data to obtain the difference between the two pieces of input data. A data comparator 18 obtains the density difference (absolute value) between the inspected pattern and the reference pattern. A spatial differentiation filter 22 is provided to the corresponding difference direction of the density difference between the inspected pattern and the reference pattern. A minimum/maximum comparator 26 obtains the minimum/maximum of the absolute value (Yamashita, col. 4, lines 35-46). The output of the comparator 18 is applied to a defect determining circuit 19. When at least one of the absolute value of the density difference, the minimum and the

maximum exceeds its corresponding threshold, the defect determining circuit 19 is adapted to determine a defect (Yamashita, col. 5, lines 36-41).

In short, Ohtombe detects defect portions on a wafer surface by a difference in brightness between diffuse reflection caused by unusual portions and Miller surface reflection caused normal portions. However, Yamashita avoids false defect detection by comparing image data representing the distribution of density of a two-dimensional inspected pattern and a pre-stored reference pattern data representing a typical pattern of a circuit pattern. Ohtombe does not need the reference signal, or the comparator calculating a difference between inspection signals and the reference signal in Yamashita at all. There is no suggestion or motivation to combine the two references as the Examiner has done.

Additionally, the principle of operation of Ohtombe is completely different from that of Yamashita. Ohtombe's comparator 45 and Yamashita's data comparator 18 follow substantially different signal processing logic, and the Ohtombe apparatus and Yamashita apparatus obtain inputs to their respective comparators and process output from their respective comparators in substantially different ways. Even assuming *arguendo* that a skilled artisan were to combine the two references, he/she would not be able to incorporate the Yamashita comparator into Ohtombe apparatus without substantially changing the principle of operation of the references and substantially redesigning the construction of the references. However, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d